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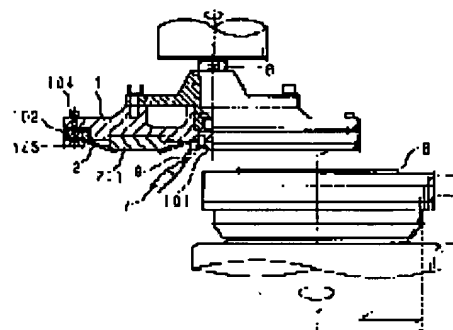
(54) POLISHING DEVICE AND POLISHING METHOD USING SAME**(57) Abstract:**

PURPOSE: To provide a polishing device capable of improving flatness microscopically by way of uniforming the contact state of an abrasive cloth surface and a sample polished surface, improving flatness of a sample and uniforming a polishing amount to the sample polished surface macroscopically.

CONSTITUTION: On the opposite side of a sample holding pedestal 3 free to rotate, placing a sample B on it, a rotatable polishing disc 1 is arranged, and on its bottom face, an abrasive cloth 2 is affixed through an elastic body 201. Polish is carried out as the polishing disc 1 and the sample holding pedestal 3 rotate,

an abrasive 8 is supplied between the abrasiv 2 and the sample polished surface and the a cloth 2 makes contact with the sample B in a range.

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CLAIMS

[Claim(s)]

[Claim 1] Polish equipment characterized by making the elastic section have intervened between said turn table and said abrasive cloth in the polish equipment which supplies an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample.

[Claim 2] Said elastic section is polish equipment according to claim 1 characterized by being a ring tabular elastic body.

[Claim 3] Said elastic section is polish equipment according to claim 1 which the whole surface is the disc-like elastic body which has the shape of the spherical surface, and is characterized by making the whole surface of the shape of the spherical surface placed between said abrasive cloth sides.

[Claim 4] Said elastic section is polish equipment according to claim 1 characterized by being the fluid enclosure section with which the fluid was enclosed.

[Claim 5] Polish equipment according to claim 4 characterized by having a means to control the pressure of the fluid of said fluid enclosure section furthermore.

[Claim 6] It is polish equipment which sets to the polish equipment which supplies an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample, and is characterized by for said abrasive cloth to possess the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface.

[Claim 7] It is polish equipment characterized by providing the 2nd elastic body with which said abrasive cloth prepared heights, the crevice, or the slot in the polish equipment which supplies an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample in the sample contact surface.

[Claim 8] Said abrasive cloth is polish equipment according to claim 2, 3, 4, or 5 with which a resin pellet and/or an abrasive material particle are characterized by providing the 2nd elastic body laid underground or attached in the sample contact surface.

[Claim 9] Said abrasive cloth is polish equipment according to claim 2, 3, 4, or 5 characterized by providing the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface.

[Claim 10] The polish approach characterized by rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample using polish equipment according to claim 1.

[Claim 11] Said elastic section is the polish approach according to claim 10 characterized by being a ring tabular elastic body.

[Claim 12] Said elastic section is the polish approach according to claim 10 which the whole surface is the disc-like elastic body which has the shape of the spherical surface, and is characterized by making the whole surface of the shape of the spherical surface placed between said abrasive cloth sides.

[Claim 13] Said elastic section is the polish approach according to claim 10 characterized by being the fluid enclosure section with which the fluid was enclosed.

[Claim 14] The polish approach according to claim 13 characterized by having a means to control the pressure of the fluid of said fluid enclosure section furthermore.

[Claim 15] The polish approach characterized by rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample using polish equipment according to claim 6.

[Claim 16] The polish approach characterized by rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample using polish equipment according to claim 7.

[Claim 17] Said abrasive cloth is the polish approach according to claim 11, 12, 13, or 14 that a resin pellet and/or an abrasive material particle are characterized by providing the 2nd elastic body laid underground or attached in the sample contact surface.

[Claim 18] Said abrasive cloth is the polish approach according to claim 11, 12, 13, or 14 characterized by providing the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the polish equipment which grinds the wafer in the middle of a large-scale flat-surface substrate especially a silicon wafer, a quartz substrate, a glass substrate, a ceramic substrate, a metal substrate, and an LSI making process etc.

[0002]

[Description of the Prior Art] Drawing 8 is the perspective view of the conventional polish equipment which grinds a large-scale flat-surface substrate. One in drawing is a disc-like turn table, and is horizontally pivotable by the rotation spindle 6. The abrasive cloth 2 which is nonwoven fabrics, such as polyurethane, is stuck on the front face by adhesives 21. The disc-like sample maintenance base 3 smaller than a surface plate 1 is arranged in the location which carried out ** length isolation from abrasive cloth 2, and level rotation and the horizontal migration of it have become possible in the abrasive cloth 2 upper part with the sample maintenance base revolving shaft 5 which was connected to the mechanical component which is not illustrated and which can be gone up and down.

[0003] Moreover, it is the side of the sample maintenance base 3, and the abrasive material supply nozzle 7 which spouts an abrasive material 8 is being fixed above the turn table 1. Sample B is held by adhesion or the vacuum chuck on the inferior surface of tongue of said sample maintenance base 3, and the pressure welding of the sample B is carried out by the polish load W on abrasive cloth 2. A turn table 1 is rotated, and a sample B front face is ground, level-rotating, carrying out horizontal migration of the sample maintenance base 3, and supplying an abrasive material 8 on abrasive cloth 2 from the abrasive material supply nozzle 7.

[0004]

[Problem(s) to be Solved by the Invention] Since abrasive cloth 2 is nonwoven fabrics, such as polyurethane, when a sample is ground with the above polish equipments, an elastic modulus is low, and since it is easy to deform to a pressure, the front face of abrasive cloth 2 becomes an ununiformity. 0.5mm of then, thickness abbreviation Although to insert a sheet between abrasive cloth 2 and a turn table 1, and to raise the surface smoothness of an abrasive cloth side was tried, since the thickness of abrasive cloth 2 was uneven, or the contact condition of an abrasive cloth side and a sample polished surface became uneven locally since adhesives 21 thickness was uneven, and the display flatness of a sample polished surface fell, this attempt was not effective.

[0005] Moreover, since the whole sample polished surface surface was in contact with the abrasive cloth side, there was a problem that the sample periphery section was easy to be ground compared with the inner circumference section, and a sample polished surface was not ground by homogeneity. In order to equalize the contact condition of an abrasive cloth side and a sample polished surface, when the load W given to Sample B was made high, there was a problem of a scratch (scratching blemish) being introduced into a polished surface, and polish distortion having arisen and spoiling the physical properties of sample original.

[0006] Moreover, when a circuit pattern is formed on a wafer substrate and an insulator layer is further

put over the whole surface on it in the middle of an LSI making process, corresponding to the existence of a circuit pattern, irregularity arises in an insulator layer. To grind the insulator layer of such a wafer, it is required to grind so that a front face may become flat in micro so that the thickness of an insulator layer may become homogeneity in macro. However, with conventional polish equipment, when elastic abrasive cloth is used, abrasive cloth also grinds a part not only for a part for heights but a crevice along with the concave convex on the front face of an insulator layer by the elastic deformation of abrasive cloth.

[0007] Drawing 9 is the typical sectional view having shown the contact condition of elastic abrasive cloth and a wafer. Wiring 84 and 84 -- are formed on the wafer substrate 81, and a it top is covered by the insulator layer 83. When grinding the front face of such a wafer, the elastic abrasive cloth 82 also contacts a part for the crevice on the front face of a wafer by the elastic deformation, and is ground. For this reason, by the time it became flatness (the difference of concavo-convex height is zero), time amount needed to be required, and thickness of an insulator layer needed to be made larger than usual. However, it could not be completely made flat, but there was a limit also in enlarging thickness of an insulator layer practical, and, in terms of micro, there was a problem that surface smoothness was low. [0008] Then, it is possible to use very hard abrasive cloth instead of elastic abrasive cloth. Drawing 10 is the typical sectional view having shown the contact condition of very hard abrasive cloth and a wafer. Wiring which is not illustrated on the wafer substrate 81 is formed, and a it top is covered by the insulator layer 83. When grinding the front face of such a wafer, since the very hard abrasive cloth 82 has the high elastic modulus, it contacts a part for the heights which was not concerned with the surface smoothness on the front face of a wafer, but was seen like a macro on the front face of a wafer, and grinds only a contact part. For this reason, there was a problem that an insulator layer 83 was not ground by thickness uniform in macro.

[0009] This invention is made in view of this situation, the contact condition of an abrasive cloth side and a sample polished surface is made into homogeneity, and uniform polish and the display flatness of a sample are raised, Moreover, reduce the load given to a sample, improve the smooth nature of a sample, and it aims at offering the polish approach using the polish equipment and this which decrease polish distortion. moreover -- in addition, in accordance with the configuration on the front face of a sample, uniform polish is performed in macro, and it aims at offering the polish approach using the polish equipment and this which raise surface smoothness in micro.

[0010]

[Means for Solving the Problem] The polish equipment concerning the 1st invention is characterized by making the elastic section have intervened between said turn table and said abrasive cloth in the polish equipment which supplies an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample.

[0011] In the polish equipment which the polish equipment concerning the 2nd invention supplies an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample, the elastic section is made to have intervened between said turn table and said abrasive cloth, and said elastic section is characterized by to be a ring tabular elastic body.

[0012] The polish equipment concerning the 3rd invention between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table In the polish equipment which supplies an abrasive material and grinds said plate-like sample, the elastic section is made to have intervened between said turn table and said abrasive cloth, said elastic section is the disc-like elastic body with which the whole surface has the shape of the spherical surface, and it is characterized by making the whole surface of the shape of the spherical surface placed between said abrasive cloth sides.

[0013] Make the elastic section have intervened between said turn table and said abrasive cloth, and said elastic section is characterized by to be the fluid enclosure section with which the fluid was enclosed in the polish equipment which the polish equipment concerning the 4th invention supplies an abrasive

material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample.

[0014] The polish equipment concerning the 5th invention between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table In the polish equipment which supplies an abrasive material and grinds said plate-like sample, the elastic section is made to have intervened between said turn table and said abrasive cloth, and said elastic section is the fluid enclosure section with which the fluid was enclosed, and is characterized by having a means to control the pressure of the fluid of said fluid enclosure section further.

[0015] The polish equipment concerning the 6th invention sets to the polish equipment which supplies an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample, and it is characterized by for said abrasive cloth to possess the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface.

[0016] In the polish equipment which the polish equipment concerning the 7th invention supplies an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and grinds said plate-like sample, said abrasive cloth is characterized by providing the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface.

[0017] The polish equipment concerning the 8th invention between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table The elastic section is made to have intervened between said turn table and said abrasive cloth in the polish equipment which supplies an abrasive material and grinds said plate-like sample. Said elastic section It is a ring tabular elastic body and said abrasive cloth is characterized by providing the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface. The elastic section is made to have intervened between said turn table and said abrasive cloth. Or said elastic section The whole surface of the shape of the spherical surface is made to be placed between said abrasive cloth sides with the disc-like elastic body with which the whole surface has the shape of the spherical surface. Said abrasive cloth A resin pellet and/or an abrasive material particle are characterized by providing the 2nd elastic body laid underground or attached in the sample contact surface. The elastic section is made to have intervened between said turn table and said abrasive cloth. Or said elastic section It is the fluid enclosure section with which the fluid was enclosed, and said abrasive cloth is characterized by providing the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface. The elastic section is made to have intervened between said turn table and said abrasive cloth. Or said elastic section It is the fluid enclosure section with which the fluid was enclosed, and it has a means to control the pressure of the fluid of said fluid enclosure section further, and is characterized by said abrasive cloth possessing the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface.

[0018] The polish equipment concerning the 9th invention between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table The elastic section is made to have intervened between said turn table and said abrasive cloth in the polish equipment which supplies an abrasive material and grinds said plate-like sample. Said elastic section It is a ring tabular elastic body and said abrasive cloth is characterized by providing the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface. The elastic section is made to have intervened between said turn table and said abrasive cloth. Or said elastic section The whole surface of the shape of the spherical surface is made to be placed between said abrasive cloth sides with the disc-like elastic body with which the whole surface has the shape of the spherical surface. Said abrasive cloth It is characterized by providing the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface. The elastic section is made to have intervened between said turn table and said abrasive cloth. Or said elastic section It is the fluid enclosure section with which the fluid was enclosed, and said abrasive cloth is characterized by providing the 2nd elastic body which

prepared heights, the crevice, or the slot in the sample contact surface. The elastic section is made to have intervened between said turn table and said abrasive cloth. Or said elastic section It is the fluid enclosure section with which the fluid was enclosed, and it has a means to control the pressure of the fluid of said fluid enclosure section further, and said abrasive cloth is characterized by providing the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface.

[0019] The polish approach concerning the 10th invention is characterized by to supply an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, to rotate independently said turn table and a sample maintenance base using the polish equipment which makes the elastic section have intervened between said turn table and said abrasive cloth, respectively, and to grind a plate-like sample.

[0020] The polish approach concerning the 11th invention is characterized by to supply an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, to rotate independently said turn table and a sample maintenance base using the polish equipment which makes the ring tabular elastic body have intervened as the elastic section between said turn table and said abrasive cloth, respectively, and to grind a plate-like sample.

[0021] The plate-like sample by which the polish approach concerning the 12th invention was held on the rotating sample maintenance base, With the disc-like elastic body with which an abrasive material is supplied between the abrasive cloth put on the rotating turn table, and the whole surface has the shape of the spherical surface as the elastic section between said turn table and said abrasive cloth It is characterized by rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample using the polish equipment which makes the whole surface of the shape of the spherical surface placed between said abrasive cloth sides.

[0022] The plate-like sample by which the polish approach concerning the 13th invention was held on the rotating sample maintenance base, Supply an abrasive material between the abrasive cloth put on the rotating turn table, and the polish equipment between which the fluid enclosure section by which the fluid was enclosed as the elastic section between said turn table and said abrasive cloth is made to be placed is used. It is characterized by rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample.

[0023] The plate-like sample by which the polish approach concerning the 14th invention was held on the rotating sample maintenance base, Supply an abrasive material between the abrasive cloth put on the rotating turn table, and the fluid enclosure section by which the fluid was enclosed as the elastic section between said turn table and said abrasive cloth is made to have intervened. It is characterized by rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample using polish equipment equipped with a means to control the pressure of the fluid of said fluid enclosure section furthermore.

[0024] It is characterized by for the polish approach concerning the 15th invention to supply an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and for said abrasive cloth to rotate independently said turn table and a sample maintenance base, respectively using the equipment which possesses the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface, and to grind a plate-like sample.

[0025] It is characterized by for the polish approach concerning the 16th invention to supply an abrasive material between the plate-like sample held on the rotating sample maintenance base, and the abrasive cloth put on the rotating turn table, and for said abrasive cloth to rotate independently said turn table and a sample maintenance base using the equipment which possesses the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface, respectively, and to grind a plate-like sample.

[0026] The plate-like sample by which the polish approach concerning the 17th invention was held on the rotating sample maintenance base, Supply an abrasive material between the abrasive cloth put on the rotating turn table, and a ring tabular elastic body is made to intervene as the elastic section between said turn table and said abrasive cloth. Said abrasive cloth The polish equipment which possesses the 2nd

elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface is used. The whole surface of the shape of the spherical surface is made to have intervened between said turn table and said abrasive cloth at said abrasive cloth side with the disc-like elastic body with which the whole surface has the shape of the spherical surface as the elastic section. Or said abrasive cloth The polish equipment which possesses the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface is used. The fluid enclosure section by which the fluid was enclosed as the elastic section between said turn table and said abrasive cloth is made to have intervened. Or said abrasive cloth The polish equipment which possesses the 2nd elastic body with which the resin pellet and/or the abrasive material particle were laid underground or attached in the sample contact surface is used. The fluid enclosure section by which the fluid was enclosed as the elastic section between said turn table and said abrasive cloth is made to have intervened, and it has a means to control the pressure of the fluid of said fluid enclosure section further. Or said abrasive cloth It is characterized by for a resin pellet and/or an abrasive material particle rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample using the equipment which possesses the 2nd elastic body laid underground or attached in the sample contact surface.

[0027] The plate-like sample by which the polish approach concerning the 18th invention was held on the rotating sample maintenance base, Supply an abrasive material between the abrasive cloth put on the rotating turn table, and the ring tabular elastic body is made to have intervened as the elastic section between said turn table and said abrasive cloth. Said abrasive cloth The polish equipment which possesses the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface is used. The whole surface of the shape of the spherical surface is made to have intervened between said turn table and said abrasive cloth at said abrasive cloth side with the disc-like elastic body with which the whole surface has the shape of the spherical surface as the elastic section. Or said abrasive cloth The polish equipment which possesses the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface is used. The fluid enclosure section by which the fluid was enclosed as the elastic section between said turn table and said abrasive cloth is made to have intervened. Or said abrasive cloth The equipment which possesses the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface is used. The fluid enclosure section by which the fluid was enclosed as the elastic section between said turn table and said abrasive cloth is made to have intervened, and it has a means to control the pressure of the fluid of said fluid enclosure section further. Or said abrasive cloth It is characterized by rotating independently said turn table and a sample maintenance base, respectively, and grinding a plate-like sample using the equipment which possesses the 2nd elastic body which prepared heights, the crevice, or the slot in the sample contact surface.

[0028]

[Function] The elastic section is made to intervene between a turn table and abrasive cloth by the polish equipment of this invention, and the polish approach using this. It grinds without the contact condition of an abrasive cloth side and a sample polished surface becoming uniform, and an abrasive cloth side covering an excessive load over the sample periphery section, in order that an abrasive cloth side may contact by narrow **** of a sample polished surface since the ring tabular elastic body is made to intervene as the elastic section.

[0029] Moreover, since the disc-like elastic body with which it replaces with a ring tabular elastic body, and the whole surface has the shape of the spherical surface is made to intervene, in order for the amount of [of a spherical-surface-like abrasive cloth side] core to contact a sample polished surface, an abrasive cloth side does not cover an excessive load over the sample periphery section. Therefore, the contact condition with a sample polished surface serves as homogeneity. Moreover, since the fluid enclosure section which enclosed the fluid similarly is made to intervene between the abrasive cloth covered by the disc-like turn table and this turn table, the configuration of the fluid enclosure section does not cover a load with an abrasive cloth side excessive in the sample periphery section, in order [to which the whole surface makes the shape of the spherical surface] to become disc-like and only for the

amount of [of an abrasive cloth side] core to contact a sample polished surface. Therefore, the contact condition with a sample polished surface serves as homogeneity. Furthermore, since the pressure of the fluid of said fluid enclosure section is controllable, it can grind in the state of the contact according to a sample.

[0030] Moreover, while the sample contact surface of abrasive cloth deforms an abrasive cloth front face into it according to the macro-surface smoothness of a sample since a resin pellet and/or an abrasive material particle are laid underground or attached in the 2nd elastic body, and it grinds a sample front face to homogeneity, the micro heights of a sample are ground and surface smoothness is raised. Moreover, since the sample contact surface of abrasive cloth establishes heights, a crevice, or a slot in the 2nd elastic body, an abrasive cloth front face deforms according to the macro-surface smoothness of a sample, and grinds the micro heights of a sample alternatively.

[0031] Said elastic section is made to intervene, and since heights, a crevice, or a slot is established in the thing by which the resin pellet and/or the abrasive material particle were laid underground or attached in the 2nd elastic body, or the 2nd elastic body, the contact to a sample polished surface and abrasive cloth becomes uniform at it, and the sample contact surface of abrasive cloth grinds a sample front face to homogeneity in macro, grinds heights alternatively in micro, and raises surface smoothness further again.

[0032]

[Example] Hereafter, this invention is concretely explained based on the drawing in which the 1st example is shown. Drawing 1 is the elevation partly in section showing the polish equipment of this invention. One in drawing is a disc-like turn table, and 3 is a disc-like sample maintenance base. A top-face core is connected with the lower limit section of the rotation spindle 6, and a turn table 1 is horizontally pivotable.

[0033] The sample maintenance base 3 fixed on the spindle 55 in which level rotation and horizontal migration are possible is arranged in the lower part of a turn table 1. A spindle 55 is arranged in the location which carried out eccentricity to the turn table 1, and only the abbreviation radius length of Sample B can carry out horizontal migration in the direction where the center of rotation of a spindle 55 deserts the core of the periphery section of abrasive cloth 2 to the turn table 1.

[0034] The circumferential groove of this alignment is formed in the inferior surface of tongue of a turn table 1. Ring tabular elastic body 201 thicker than that depth to this circumferential groove It is attached and the condition of having projected rather than the turn table 1 is made. The step is formed in the turn table 1 periphery marginal inferior surface of tongue, and it is a stop ring 102. It is attached. Stop rings 102, 103, and 103 and -- fasten the periphery section, and abrasive cloth 2 is an elastic body 201 about a center section. The inferior surface of tongue is covered. A turn table 1 periphery edge is a stop ring 102, 103. And bolt 104, 104 which penetrates a turn table 1 -- is fixed and the tension of abrasive cloth 2 is a bolt 104, 104. -- can adjust now.

[0035] The center section of abrasive cloth 2 is said elastic body 201. Stationary plate 101 thinner than the thickness projected from the turn table It is fixed to a turn table 1 and the impression is formed. Near the center of abrasive cloth 2, the abrasive material supply nozzle 7 which spouts an abrasive material 8 is arranged.

[0036] Hereafter, one example of the concrete conditions which grind using this equipment is explained. as Sample B -- the diameter silicon wafer of macrostomia with a diameter of 8 inches -- a vacuum chuck 4 -- the sample maintenance base 3 top -- fixing -- elastic body 201 **** -- chloroprene rubber (65 HS from 15mm of thickness abbreviation to 20mm = tensile strength of 80kg/cm²) abrasive cloth 2 -- the mixture of polyurethane resin and fiber -- using it -- elastic body 201 0.1mm of abbreviation It adjusts to the tension which is deforming extent. It is SiO₂ first. Ultrafine particle (up to mean-particle-diameter 0.1 μm to 0.2 μm) Weak alkali (from pH10 up to 12) The sample maintenance base 3 in which 2000rpm and Sample B are laid for the turn table 1 is rotated by 200rpm, supplying the abrasive material 8 which liquid was made to suspend to a polished surface by part for 31./.

[0037] Next, the sample maintenance base 3 is moved to the location which has the periphery section of abrasive cloth 2 on the vertical of this center of rotation. Abrasive cloth 2 drops a turn table 1 to the

location in contact with Sample B. This contact location is determined by detection of the motor output load of the rotation spindle 6 made to rotate a turn table 1.

[0038] It is an elastic body 201 further by this contact location. 0.3mm of abbreviation A turn table 1 is made to press down to the deforming location. Only the abbreviation radius length of Sample B vibrates horizontally the sample maintenance base 3 in which Sample B was laid in the direction which deserts the core of a turn table 1, and Sample B is ground. Sample B can be ground to homogeneity by such polish. Moreover, the periphery section of Sample B can be ground more to homogeneity by grinding, where the rotation spindle 6 which rotates a turn table 1 is leaned in the direction of a vertical several times.

[0039] After contacting a turn table 1 on the front face of Sample B unlike the approach furthermore mentioned above, you may grind without making a turn table 1 press down. In this case, the water screen of an abrasive material 8 is formed in a sample B front face of rotation of a turn table 1 and the sample maintenance base 3, and it is an elastic body 201 by the pressure of this water screen. It deforms and is several micrometers between a sample B polished surface and abrasive cloth 2 front face. A gap occurs. The polish of abrasive cloth 2 and a sample B polished surface in non-contact or the condition near this is attained by this gap. Thus, a sample B polished surface can be further ground to homogeneity rather than the above-mentioned approach.

[0040] Moreover, when Sample B is the wafer in which wiring and an insulator layer were formed on the silicon wafer substrate, how to use and grind above-mentioned polish equipment is explained below. Drawing 2 is the typical sectional view showing the structure of Sample B. The surface smoothness of the diameter silicon wafer substrate 31 of macrostomia with a diameter of 8 inches is 2-3 micrometers, wiring 34 and 34 -- were formed on this, it covered this, and the insulator layer 33 has deposited it. Thickness distribution of an insulator layer 33 is 10%, and the surface smoothness of Sample B is 3-4 micrometers. Such a sample B is fixed on the sample maintenance base 3 by the vacuum chuck 4. elastic body 201 **** -- silicone rubber (55 HS= from 15mm of thickness abbreviation to 20mm tensile strength of 80kg/cm²), and abrasive cloth 2 -- the mixture of polyurethane resin and fiber -- using it -- elastic body 201 0.1mm of abbreviation the tension which is deforming extent -- adjusting -- the thickness of abrasive cloth 2 -- 0.8mm If it considers as the following and is possible It may be 0.5mm or less. It is SiO₂ first. Ultrafine particle (up to mean-particle-diameter 0.1 μm to 0.2 μm) Weak alkali (from pH10 up to 12) The sample maintenance base 3 in which 2000rpm and Sample B are laid for the turn table 1 is rotated by 200rpm, supplying the abrasive material 8 which liquid was made to suspend to a polished surface by part for 3l./.

[0041] Abrasive cloth 2 is hard thickness. Since what was set to 0.8mm or less is used, they are abrasive cloth 2 and an elastic body 201. Since a configuration does not meet the micro irregularity [a configuration] of the contact surface of Sample B along with the macro-irregularity of the contact surface of Sample B, abrasive cloth 2 can perform efficient micro flattening all over sample B.

[0042] In addition, in the case of the soft quality of the material [like the sponge made from a chloroprene] whose thickness of abrasive cloth 2 is, it is an elastic body 201. It is desirable for deformation change to set up so that the pressure variation of polish constant ** 1 may become 20% or less to 3-4 micrometers. Moreover, you may be the sheet made from Teflon, a nonwoven fabric, the polyurethane resin made from foaming, an oxide particle like cerium oxide, or resin containing a diamond particle in addition to what was shown in abrasive cloth 2 in the above-mentioned example.

[0043] Drawing 3 is the elevation partly in section showing the 2nd example of this invention. A top-face core is connected with the lower limit section of the rotation spindle 6, and a turn table 1 is horizontally pivotable. The sample maintenance base 3 fixed on the spindle 55 in which level rotation and horizontal migration are possible is arranged in the lower part of a turn table 1. A spindle 55 is arranged in a turn table 1 and this cardiac location, and the center of rotation of a spindle 55 can carry out horizontal migration of the abbreviation radius length of a sample in the direction of a periphery from the core of abrasive cloth 2.

[0044] The impression which carried out the round shape of this alignment is formed in the inferior surface of tongue of a turn table 1. Disc-like elastic body 202 with which the whole surface has the

shape of the spherical surface in this impression It is attached. And it is thicker than the depth of an impression and the periphery section is an elastic body 202. The condition of having projected rather than the turn table 1 is made.

[0045] This elastic body 202 It covers and abrasive cloth 2 is being fixed like the 1st example. When grinding with such equipment, Sample B is first laid on the sample maintenance base 3. And the core grinds by only the abbreviation radius length of Sample B doing horizontal migration of the sample maintenance base 3 in the direction of turn table 1 periphery from the core of a turn table 1. Thus, a sample B polished surface can be ground to homogeneity. Moreover, by grinding, where the rotation spindle 6 which rotates a turn table 1 is leaned in the direction of a vertical several times, concentration of the contact location to the sample B of abrasive cloth 2 can be avoided, and the abrasion resistance of abrasive cloth 2 can be improved.

[0046] Drawing 4 is the elevation partly in section showing the 3rd example of this invention. One in drawing is a disc-like turn table, and a top-face core is connected by the lower limit section of the rotation spindle 6, and it is horizontally pivotable. The disc-like sample maintenance base 3 in which the sample fixed on the spindle 55 in which level rotation and horizontal migration are possible is laid is arranged in the lower part of a turn table 1. A spindle 55 is arranged in a turn table 1 and this cardiac location, and the center of rotation of a spindle 55 can carry out horizontal migration only of the radius length of a sample in the direction of a periphery at least from the core of abrasive cloth 2.

[0047] The impression which carried out the round shape of this alignment is formed in the inferior surface of tongue of a turn table 1. They are stop rings 102, 103, and 103, --, a bolt 104, 104 like [the turn table 1 bottom / the periphery section of abrasive cloth 2] the 1st example. -- is fixed. The enclosure bag 9 is inserted between a turn table 1 and abrasive cloth 2. And it is a liquid 203 to the enclosure bag 9. The top-face center section of the enclosure bag 9 is equipped with the duct 10 for supply for supplying through the core of the rotation spindle 6.

[0048] It is a liquid 203 from this duct 10 for supply to the enclosure bag 9. It is poured in and the fluid enclosure section which has the shape of the spherical surface is formed between a turn table 1 and abrasive cloth 2. And near the center of abrasive cloth 2, the abrasive material supply nozzle 7 which spouts an abrasive material 8 is arranged. When grinding with such equipment, Sample B is first laid on the sample maintenance base 3. And the constant-pressure pump which is not illustrated is used for the enclosure bag 9 from said duct 10 for supply, and it is a liquid 203. By pouring in, it is the liquid 203 in the enclosure bag 9. A pressure can be adjusted. At this time, as for abrasive cloth 2, that inferior surface of tongue is the spherical surface mostly with the configuration of the liquid enclosure section.

[0049] Next, the revolving shaft of the sample maintenance base 3 and the revolving shaft of a turn table 1 move the sample maintenance base 3 to the location used as the same apparent vertical, and grind by putting each rotation into operation. thus, it can grind to homogeneity by pressing each location of a sample B polished surface by the pressure of about 1 law. The sample maintenance base 3 may be ground making it move to radial [of a sample], although it may fix to the location where a turn table 1 and a revolving shaft become the same as mentioned above and you may grind. In addition, although the liquid is enclosed with the enclosure bag 9 in this example, even if it replaces with a liquid and encloses a gas, it does not interfere.

[0050] Drawing 5 is the abrasive cloth 2 of the polish equipment shown in drawing 1 which is the typical fragmentary sectional view of the polish equipment in which the 4th example of this invention is shown, and is the 1st above-mentioned example, Ring tabular elastic body 201 And it is the sectional view which expanded Sample B. Drawing 5 (a) Abrasive cloth 2 is the 2nd elastic body 204 like elasticity polyurethane rubber so that it may be shown. It is the resin pellet 205, 205 to a contact-in Sample B side. Elastic body 201 which is the thing of the structure which embedded -- and consists of chloroprene rubber between this abrasive cloth 2 and turn table 1 (drawing 1) It is made to have intervened. Resin pellet 205, 205 Diameter which becomes -- from a vinyl chloride or polyethylene A 0.3mm spherical thing is used. Sample B is the thing of the structure where wiring 54, 54, --, and an insulator layer 53 were formed on the silicon wafer 51, and grinds the surface insulator layer 53 by performing the same polish as the 1st above-mentioned example. The front face of Sample B is the resin

pellet 205,205 which has concave convex by wiring 54 and 54 --, and abrasive cloth 2 has in the case of polish. -- grinds a part for the heights of an insulator layer 53 alternatively, and does not contact a part for a crevice. The surface smoothness of Sample B which this saw in micro improves.

[0051] Moreover, drawing 5 (b) Drawing 5 (a) Abrasive cloth 2, Ring tabular elastic body 201 And it is the typical sectional view having shown Sample B in macro. In addition, the resin pellet 205, 205 -- and wiring 54, and 54 -- are omitting. When a sample B front face is ground, in accordance with the configuration of a sample B front face where it saw in macro, extent of polish of a sample B front face serves as [the configuration of abrasive cloth 2] homogeneity by the elastic deformation of the 2nd elastic body 204 of abrasive cloth 2.

[0052] In addition, an above-mentioned resin pellet is a diameter which a thing harder than the 2nd elastic body is desirable, and becomes from a vinyl chloride or polyethylene. Although the 0.3mm spherical thing is used, it does not restrict to this, and they are aluminum 2O3 with a particle size of 1 micrometer or less and CeO2. Or a vinyl chloride or polyethylene could be made to contain particles, such as a diamond.

[0053] Moreover, at the 4th above-mentioned example, it is the resin pellet 205,205 of abrasive cloth 2. -- The 2nd elastic body 204 Although the case in the condition of having been laid under the sample B side front face is explained, it is the 2nd elastic body 204, for example. You may be in the condition fixed and attached in the adhesion side established in the sample B side front face.

[0054] Next, drawing 6 is the abrasive cloth 2 of the polish equipment shown in drawing 1 which is the typical fragmentary sectional view of the polish equipment in which the 5th example of this invention is shown, and is the 1st above-mentioned example, Ring tabular elastic body 201 And it is the sectional view which expanded Sample B. As shown in drawing 6, abrasive cloth 2 is the 2nd elastic body 206. They are Crevices 206a and 206a to a contact-in Sample B side. The configuration thing which prepared -- is used. The 2nd elastic body 206 For example, thickness which a nonwoven fabric infiltrates polyurethane rubber and was made hard It is a 1.5mm pad and an opening part to this The depth is 1.4mm at 0.1mmx 0.1mm. Crevices 206a and 206a of a dimension -- Pitch It is prepared by 1.5mm. Sample B is the thing of the structure where wiring 54, 54 --, and an insulator layer 53 were formed on the silicon wafer 51. SiO2 ultrafine particle (0.2 from mean particle diameter of 0.05 micrometers mum extent) Weak alkali (from pH10 up to 12) Supplying the abrasive material 8 which liquid was made to suspend to a polished surface by part for 3l./ The sample maintenance base 3 in which 2000rpm and Sample B are laid for the turn table 1 is rotated by 200rpm. And it grinds like the 1st above-mentioned example. At this time, it is the 2nd elastic body 206 of abrasive cloth 2. Since it is hard, the micro irregularity of Sample B is not followed but the micro surface smoothness of Sample B improves. Moreover, the 2nd elastic body of abrasive cloth 2 In accordance with the configuration of a sample B front face, the amount of polishes of a sample B front face serves as homogeneity in macro by having formed crevice 206a and 206a-- in 206.

[0055] In addition, the 2nd elastic body 206 of the abrasive cloth 2 used in the above-mentioned example 5 Although it is the opening part of the prepared crevice, and the dimension of 0.1mmx 0.1mm, it may not restrict to this and you may be a groove crevice. Moreover, the 2nd elastic body 206 Heights may be prepared in the sample B side front face.

[0056] Next, the 4th example equipment mentioned above is used and it is SiO2. The wafer which deposited the film is ground and the result of having measured the surface smoothness is shown. Drawing 7 is drawing 5 (a). It is the graph of the result of having measured the level difference of the sample B front face of ** which grinds with the polish equipment in which the part was shown. An axis of ordinate shows a surface level difference, and the axis of abscissa shows the location (dimension) of a circuit pattern. The level difference of 2 micrometers of abbreviation before polish is 0.5 in the count of polish so that clearly from a graph. It decreases to mum and it turns out that surface smoothness is improving.

[0057]

[Effect of the Invention] Since the disc-like elastic body with which ring tabular or the whole surface has the shape of the spherical surface, or a fluid is made to intervene between a turn table and abrasive

cloth in the polish equipment of this invention, and the polish approach using this as mentioned above, the contact condition of an abrasive cloth side and a sample polished surface can become homogeneity, and the display flatness of a sample can be raised. Moreover, since the pressure of a fluid is controllable, the pushing force to the sample polished surface of an abrasive cloth side is easily controllable.

[0058] Furthermore, since it grinds by preparing a gap between an abrasive cloth side and a sample polished surface, and supplying an abrasive material to this gap, the load given to a sample can be reduced, the smooth nature of a sample can be improved, and polish distortion can be decreased.

[0059] Moreover, by using the 2nd elastic body for abrasive cloth, and laying underground or attaching a resin pellet and/or an abrasive material particle in the sample contact surface side of this elastic body, a sample is ground in thickness uniform in macro, and the micro surface smoothness of a sample polished surface improves. Furthermore, by using the abrasive cloth of the 2nd elastic body which established heights, the crevice, or the slot in the sample contact surface, a sample is ground in thickness uniform in macro, and the micro surface smoothness of a sample polished surface improves. Moreover, this invention does the outstanding effectiveness so by making the elastic section intervene between a turn table and abrasive cloth, and using the 2nd elastic body for abrasive cloth further -- the surface smoothness of a sample can be improved further.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the elevation partly in section showing the polish equipment of the 1st example of this invention.

[Drawing 2] It is the typical sectional view showing a part of polish sample.

[Drawing 3] It is the elevation partly in section showing the polish equipment of the 2nd example of this invention.

[Drawing 4] It is the elevation partly in section showing the polish equipment of the 3rd example of this invention.

[Drawing 5] It is the typical sectional view showing some polish equipments of the 4th example of this invention.

[Drawing 6] It is the typical sectional view showing some polish equipments of the 5th example of this invention.

[Drawing 7] It is the graph which measured the level difference on the front face of a sample of ** which grinds with the polish equipment of the 4th example.

[Drawing 8] It is the perspective view showing the structure of conventional polish equipment.

[Drawing 9] It is the typical sectional view showing some conventional polish equipments.

[Drawing 10] It is the typical sectional view showing some conventional polish equipments.

[Description of Notations]

1 Turn Table

2 Abrasive Cloth

3 Sample Maintenance Base

8 Abrasive Material

9 Enclosure Bag

10 Duct for Supply

201,202 Elastic body

203 Liquid

204 2nd Elastic Body

205 Resin Pellet

206 2nd Elastic Body

206a Crevice

B Sample

[Translation done.]

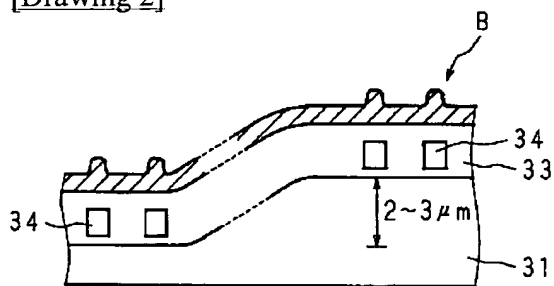
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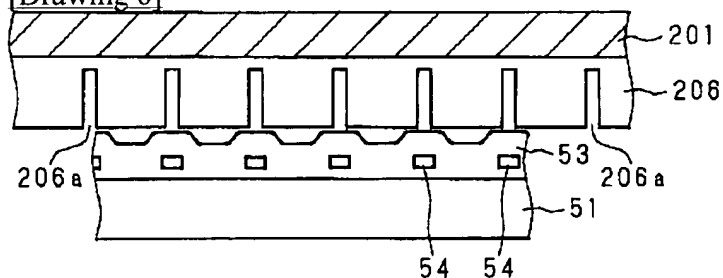
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DRAWINGS

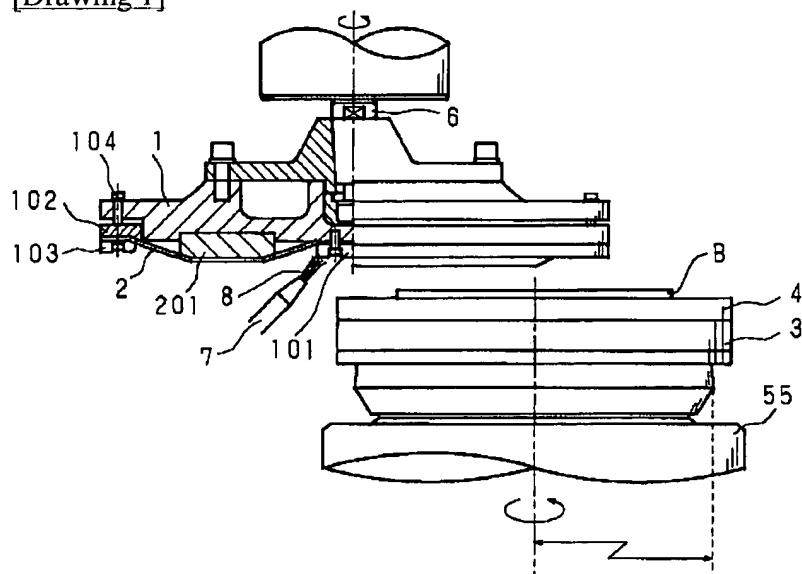
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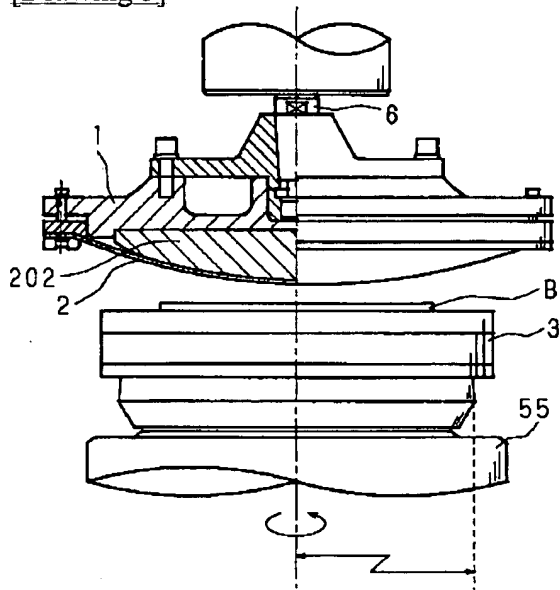
[Drawing 6]



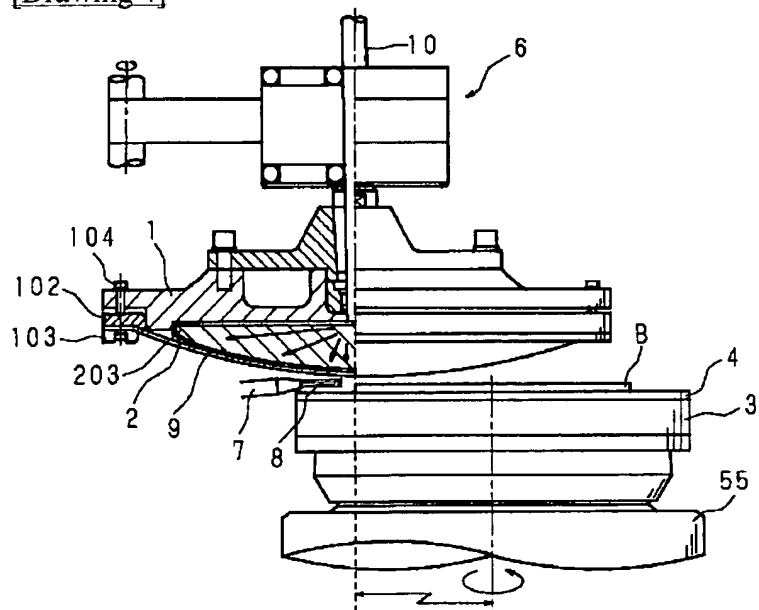
[Drawing 1]



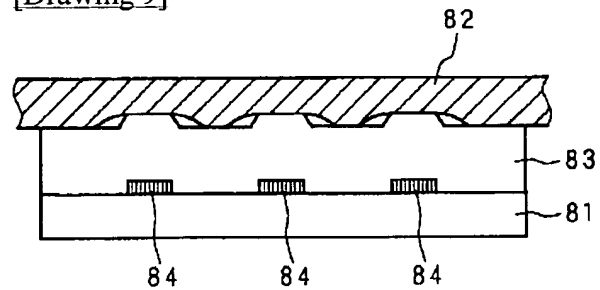
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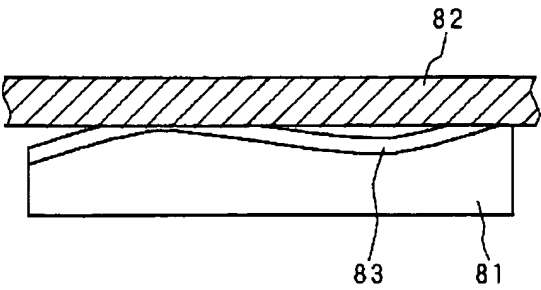
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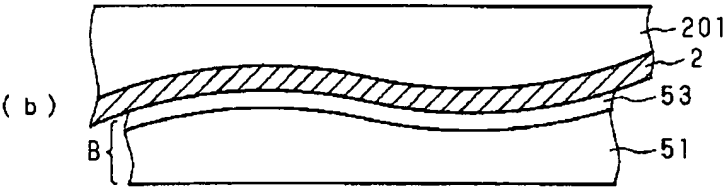
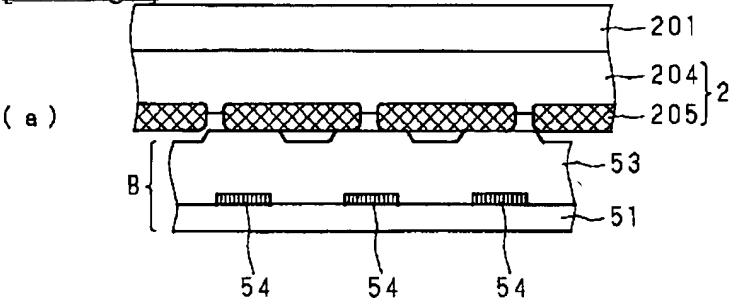
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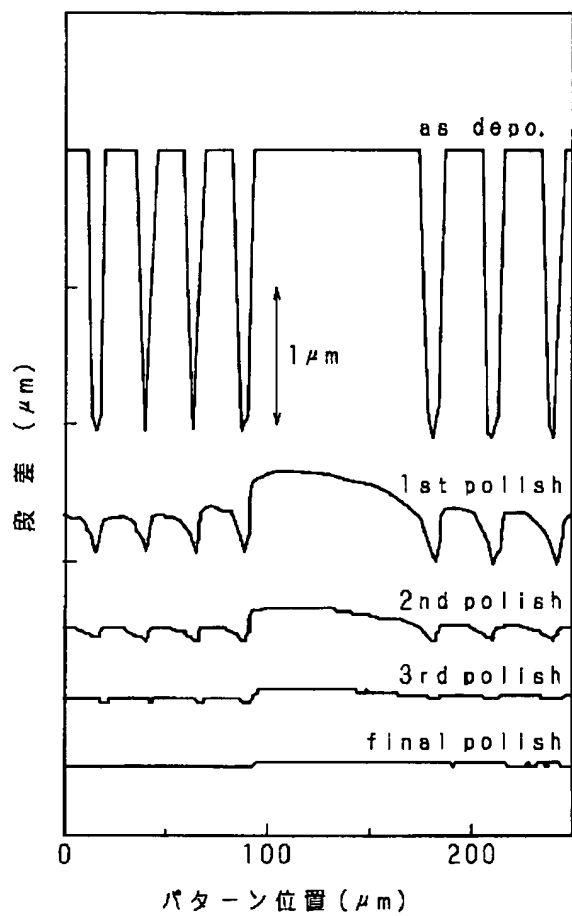
[Drawing 10]



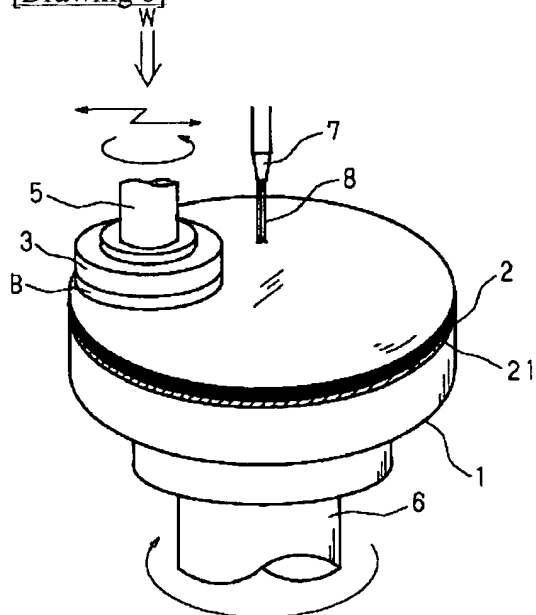
[Drawing 5]



[Drawing 7]



[Drawing 8]



[Translation done.]

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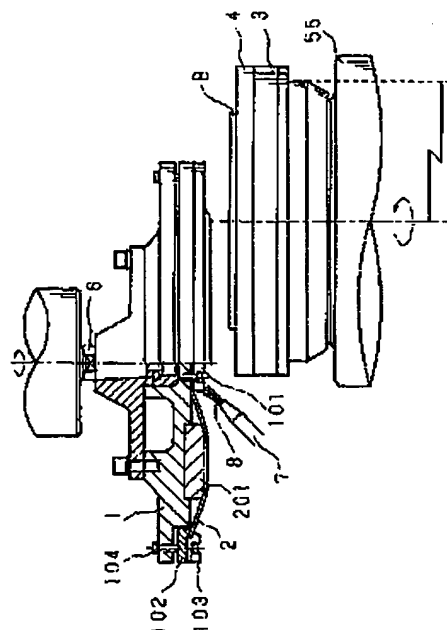
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(54)【発明の名称】 研磨装置及びこれを用いた研磨方法

(57)【要約】

【目的】 研磨布面及び試料研磨面の接触状態を均一にし、試料の平坦度を向上させること、またマクロ的に試料研磨面への研磨量を均一にし、ミクロ的に平坦度を向上させる研磨装置及びこれを用いた研磨方法を提供する。

【構成】 試料Bを載置する回転可能な試料保持台3の対向側に、回転可能な研磨定盤1が配置され、その下面には弾性体201を介して研磨布2が張着されている。研磨定盤1及び試料保持台3が回転し、研磨剤8が研磨布2及び試料研磨面の間に供給されながら、研磨布2が狭い範囲で試料Bに接触し、研磨を行う。



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【特許請求の範囲】

【請求項1】 回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあることを特徴とする研磨装置。

【請求項2】 前記弾性部は、環板状の弾性体であることを特徴とする請求項1記載の研磨装置。

【請求項3】 前記弾性部は、一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてあることを特徴とする請求項1記載の研磨装置。

【請求項4】 前記弾性部は、流体が封入された流体封入部であることを特徴とする請求項1記載の研磨装置。

【請求項5】 さらに前記流体封入部の流体の圧力を制御する手段を備えてあることを特徴とする請求項4記載の研磨装置。

【請求項6】 回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とする研磨装置。

【請求項7】 回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とする研磨装置。

【請求項8】 前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とする請求項2、3、4又は5記載の研磨装置。

【請求項9】 前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とする請求項2、3、4又は5記載の研磨装置。

【請求項10】 請求項1記載の研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする研磨方法。

【請求項11】 前記弾性部は、環板状の弾性体であることを特徴とする請求項10記載の研磨方法。

【請求項12】 前記弾性部は、一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてあることを特徴とする請求項10記載の研磨方法。

【請求項13】 前記弾性部は、流体が封入された流体封入部であることを特徴とする請求項10記載の研磨方法。

【請求項14】 さらに前記流体封入部の流体の圧力を制御する手段を備えてあることを特徴とする請求項13

記載の研磨方法。

【請求項15】 請求項6記載の研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする研磨方法。

【請求項16】 請求項7記載の研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする研磨方法。

【請求項17】 前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とする請求項11、12、13又は14記載の研磨方法。

【請求項18】 前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とする請求項11、12、13又は14記載の研磨方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は大型平面基板、特にシリコンウエハ、石英基板、ガラス基板、セラミックス基板、金属基板、LSI作製工程途中のウエハ等を研磨する研磨装置に関する。

【0002】

【従来の技術】図8は大型平面基板を研磨する従来の研磨装置の斜視図である。図中1は円板状の研磨定盤であり、回転スピンドル6により水平回転可能となっている。その表面にポリウレタン等の不織布である研磨布2が接着剤21により貼り付けられている。研磨布2上方には定盤1より小さな円板状の試料保持台3が研磨布2から適長離れた位置に配置され、図示しない駆動部に接続された昇降可能な試料保持台回転軸5により水平回転、水平移動可能になっている。

【0003】また、試料保持台3の側方であって研磨定盤1の上方には研磨剤8を噴出する研磨剤供給ノズル7が固定されている。前記試料保持台3の下面に試料Bを接着又は真空チャックにより保持し、試料Bを研磨布2上に研磨負荷Wで圧接する。研磨定盤1を回転させ、試料保持台3を水平回転、水平移動させて研磨剤供給ノズル7から研磨剤8を研磨布2上に供給しながら試料B表面を研磨する。

【0004】

【発明が解決しようとする課題】以上のような研磨装置により試料を研磨した場合は研磨布2がポリウレタン等の不織布であるため弾性率が低く、圧力に対して変形し易いので研磨布2の表面が不均一になる。そこで厚み略0.5mmのシートを研磨布2と研磨定盤1との間に挿入して、研磨布面の平坦性を高めることが試みられたが、研磨布2の厚みが不均一であったり、接着剤21厚みが不均一であるため、研磨布面と試料研磨面との接触状態が局部的に不均一となり、試料研磨面の平坦度が低下するので、この試みは有効ではなかった。

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【0005】また、試料研磨面全面が研磨布面と接しているため、試料周縁部が内周部に較べて研磨され易く、試料研磨面が均一に研磨されないという問題があった。研磨布面と試料研磨面との接触状態を均一化するために、試料Bに与える負荷Wを高くする場合は、研磨面にスクラッチ（ひっかき傷）が導入されたり、また研磨歪が生じて試料本来の物性を損なうという問題があった。

【0006】また、LSI作製工程途中で、ウエハ基板上に配線パターンが形成され、さらにその上に全面にわたって絶縁膜が被着された場合は、配線パターンの有無に対応して絶縁膜に凹凸が生じる。このようなウエハの絶縁膜を研磨する場合は、マクロ的には絶縁膜の厚みが均一になるように、またミクロ的には表面が平坦になるように研磨を行うことが必要である。しかしながら、従来の研磨装置では軟質の研磨布を使用した場合は、研磨布の弾性変形により、絶縁膜表面の凹凸面に研磨布が沿い、凸部分のみでなく凹部分をも研磨する。

【0007】図9は、軟質の研磨布とウエハとの接触状態を示した模式的断面図である。ウエハ基板81上に配線84、84'が形成されており、その上は絶縁膜83で覆われている。このようなウエハの表面を研磨する場合に、軟質の研磨布82は、その弾性変形によりウエハ表面の凹部分にも接触し研磨する。このために、平坦（凹凸の高さの差が零）になるまでには時間を要し、通常よりも絶縁膜の厚みを大きくする必要があった。しかしながら、実用的には絶縁膜の厚みを大きくすることにも限度があり、完全に平坦にすることができず、ミクロ的に見て平坦性が低いという問題があった。

【0008】そこで、軟質の研磨布の代わりに極めて硬質の研磨布を使用することが考えられる。図10は、極めて硬質の研磨布とウエハとの接触状態を示した模式的断面図である。ウエハ基板81上に図示しない配線が形成されており、その上は絶縁膜83で覆われている。このようなウエハの表面を研磨する場合に、極めて硬質の研磨布82は弾性率が高いために、ウエハ表面の平坦性に関わらずウエハ表面のマクロ的に見た凸部分と接触し、接触部分だけを研磨する。このために、絶縁膜83がマクロ的に均一な厚みに研磨されないという問題があった。

【0009】本発明はかかる事情に鑑みてなされたものであり、研磨布面と試料研磨面との接触状態を均一にし、試料の均一な研磨及び平坦度を向上させること、また試料に与える負荷を低減し、試料の平滑性を向上し、研磨歪を減少させる研磨装置及びこれを用いた研磨方法を提供することを目的とし、またこれに加えて、マクロ的には試料表面の形状に沿った均一な研磨を行い、ミクロ的には平坦性を向上させる研磨装置及びこれを用いた研磨方法を提供することを目的とする。

【0010】

【課題を解決するための手段】第1発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回

転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあることを特徴とする。

【0011】第2発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、環板状の弾性体であることを特徴とする。

【0012】第3発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてあることを特徴とする。

【0013】第4発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、流体が封入された流体封入部であることを特徴とする。

【0014】第5発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、流体が封入された流体封入部であり、さらに前記流体封入部の流体の圧力を制御する手段を備えてあることを特徴とする。

【0015】第6発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨布は、樹脂ベレットおよび/または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とする。

【0016】第7発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とする。

【0017】第8発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に被着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び

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前記研磨布の間に弾性部を介在させてあり、前記弾性部は、環板状の弾性体であり、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とし、又は、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてあり、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とし、又は、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、流体が封入された流体封入部であり、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とし、又は、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、流体が封入された流体封入部であり、さらに前記流体封入部の流体の圧力を制御する手段を備えてあり、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備することを特徴とする。

【0018】第9発明に係る研磨装置は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に、研磨剤を供給して前記平板状試料を研磨する研磨装置において、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、環板状の弾性体であり、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とし、又は、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてあり、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とし、又は、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、流体が封入された流体封入部であり、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とし、又は、前記研磨定盤及び前記研磨布の間に弾性部を介在させてあり、前記弾性部は、流体が封入された流体封入部であり、さらに前記流体封入部の流体の圧力を制御する手段を備えてあり、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備することを特徴とする。

【0019】第10発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨定盤及び前記研磨布の間に弾性部を介在させてある研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0020】第11発明に係る研磨方法は、回転する試

料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨定盤及び前記研磨布の間に弾性部として環板状の弾性体を介在させてある研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0021】第12発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨定盤及び前記研磨布の間に弾性部として一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてある研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0022】第13発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨定盤及び前記研磨布の間に弾性部として流体が封入された流体封入部を介在させてある研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0023】第14発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨定盤及び前記研磨布の間に弾性部として流体が封入された流体封入部を介在させてあり、さらに前記流体封入部の流体の圧力を制御する手段を備えた研磨装置を用い、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0024】第15発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備した装置を用いて、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0025】第16発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備した装置を用いて、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0026】第17発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨定盤及び前記研磨布の間に弾性部として環板状の弾性体を介在させ、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備した研磨装置を用い、又は、前記研磨定

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盤及び前記研磨布の間に弾性部として一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてあり、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備した研磨装置を用い、又は、前記研磨定盤及び前記研磨布の間に弾性部として流体が封入された流体封入部を介在させてあり、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備した研磨装置を用い、又は、前記研磨定盤及び前記研磨布の間に弾性部として流体が封入された流体封入部を介在させてあり、さらに前記流体封入部の流体の圧力を制御する手段を備え、前記研磨布は、樹脂ベレットおよび／または研磨剤粒子が埋設または着設された第2の弾性体を試料接触面に具備した装置を用いて、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0027】第18発明に係る研磨方法は、回転する試料保持台に保持された平板状試料と、回転する研磨定盤に装着された研磨布との間に研磨剤を供給し、前記研磨定盤及び前記研磨布の間に弾性部として環板状の弾性体を介在させてあり、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備した研磨装置を用い、又は、前記研磨定盤及び前記研磨布の間に弾性部として一面が球面状を有する円盤状の弾性体で、その球面状の一面を前記研磨布側に介在させてあり、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備した研磨装置を用い、又は、前記研磨定盤及び前記研磨布の間に弾性部として流体が封入された流体封入部を介在させてあり、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備した装置を用い、又は、前記研磨定盤及び前記研磨布の間に弾性部として流体が封入された流体封入部を介在させてあり、さらに前記流体封入部の流体の圧力を制御する手段を備え、前記研磨布は、凸部、凹部又は溝部を設けた第2の弾性体を試料接触面に具備した装置を用いて、前記研磨定盤及び試料保持台を夫々独立に回転させて平板状試料を研磨することを特徴とする。

【0028】

【作用】本発明の研磨装置及びこれを用いた研磨方法では、弾性部を研磨定盤と研磨布との間に介在させている。弾性部として環板状の弾性体を介在させているので、研磨布面が試料研磨面の狭い範囲で接触するため研磨布面と試料研磨面との接触状態が均一となり、研磨布面が試料周縁部に余分な負荷をかけることなく、研磨を行う。

【0029】また、環板状の弾性体に代えて一面が球面状を有する円盤状の弾性体を介在させているので、球面状の研磨布面の中心部分が試料研磨面と接触するため、研磨布面が試料周縁部に余分な負荷をかけることがな

い。したがって、試料研磨面との接触状態は均一となる。また、同様に流体を封入した流体封入部を円盤状の研磨定盤と該研磨定盤に装着された研磨布との間に介在させているので、流体封入部の形状は一面が球面状をなす円盤状となり、研磨布面の中心部分だけが試料研磨面と接触するため、研磨布面が試料周縁部に余分な負荷をかけることがない。したがって、試料研磨面との接触状態は均一となる。また、さらに前記流体封入部の流体の圧力を制御することができるので、試料に応じた接触状態で研磨することができる。

【0030】また、研磨布の試料接触面が第2の弾性体に樹脂ベレットおよび／または研磨剤粒子が埋設または着設されたものである。研磨布表面が試料のマクロ的な平坦性に合わせて変形し、試料表面を均一に研磨すると共に、試料のミクロ的な凸部を研磨して、平坦性を向上させる。また、研磨布の試料接触面が第2の弾性体に凸部、凹部又は溝部を設けたものである。研磨布表面が試料のマクロ的な平坦性に合わせて変形し、試料のミクロ的な凸部を選択的に研磨する。

【0031】さらにまた、前記弾性部を介在させ、かつ、研磨布の試料接触面が第2の弾性体に樹脂ベレットおよび／または研磨剤粒子が埋設または着設されたものである。又は第2の弾性体に凸部、凹部又は溝部を設けたものである。試料研磨面と研磨布との接触は均一となり、マクロ的には試料表面を均一に研磨し、ミクロ的には凸部を選択的に研磨して平坦性を向上させる。

【0032】

【実施例】以下、本発明をその第1実施例を示す図面に基づき具体的に説明する。図1は本発明の研磨装置を示す部分断面正面図である。図中1は円盤状の研磨定盤であり、3は円板状の試料保持台である。研磨定盤1は上面中心が回転スピンドル6の下端部と追従され、水平回転可能となっている。

【0033】研磨定盤1の下方には、水平回転、水平移動可能なスピンドル55上に載設された試料保持台3が配設されている。スピンドル55は研磨定盤1と偏心した位置に配置され、スピンドル55の回転中心が研磨布2の周縁部から、研磨定盤1の中心から離反する方向へ試料Bの略半径だけ水平移動することができる。

【0034】研磨定盤1の下面には、同心の周溝が形成されている。この周溝にはその深さよりも厚い環板状の弾性体201が嵌着され、研磨定盤1よりも突出した状態をなしている。研磨定盤1外周縁下面には段部が形成されており、固定リング102が嵌着されている。研磨布2はその周縁部を固定リング102、103、103…により挟着され、中央部を弾性体201の下面に被着されている。研磨定盤1外周縁は、固定リング102、103及び研磨定盤1を嵌通するボルト104、104…によって固定され、また研磨布2の張力はボルト104、104…により調整できるようになっている。

【0035】研磨布2の中央部は、前記弾性体201が研磨定盤から突出した厚みよりも薄い固定板101により研磨定盤1に固定され、くぼみを形成している。研磨布2の中央付近には研磨剤8を噴出する研磨剤供給ノズル7が配置されている。

【0036】以下、この装置を使用して研磨を行う具体的条件の1例を説明する。試料Bとして直径8インチの大口径シリコンウエハを真空チャック4により試料保持台3上に固定し、弾性体201にはクロロブレンゴム（厚み略15mmから20mmまで、 $H_s = 65$ 、引張強さ80kg/cm²）、研磨布2はポリウレタン樹脂と繊維との混合体を使用し、弾性体201が略0.1mm変形する程度の張力に調整する。まずSiO₂超微粒子（平均粒径0.1μmから0.2μmまで）を弱アルカリ（pH10から12まで）液に懸濁させた研磨剤8を3リットル/分で研磨面に供給しながら、研磨定盤1を2000rpm、試料Bを載置している試料保持台3を200rpmで回転させる。

【0037】次に試料保持台3をこの回転中心の鉛直上に研磨布2の周縁部が在る位置に移動する。研磨定盤1を研磨布2が試料Bと接触する位置まで降下させる。この接触位置は研磨定盤1を回転させる回転スピンドル6のモータ出力負荷の検出により決定される。

【0038】この接触位置によりさらに弾性体201が略0.3mm変形する位置まで研磨定盤1を圧下させる。試料Bを載置した試料保持台3を、研磨定盤1の中心から離反する方向へ試料Bの略半径長だけ水平に振動させ、試料Bを研磨する。このような研磨により試料Bを均一に研磨することができる。また、研磨定盤1を回転させる回転スピンドル6を鉛直方向に数度傾けた状態で研磨を行うことにより、試料Bの周縁部をより均一に研磨することができる。

【0039】さらに前述した方法とは異なり、研磨定盤1を試料Bの表面に接触させた後、研磨定盤1を圧下せずに研磨を行っても良い。この場合は、研磨定盤1及び試料保持台3の回転により研磨剤8の水膜が試料B表面に形成され、この水膜の圧力により弾性体201が変形して試料B研磨面及び研磨布2表面の間に数μmの間隙が発生する。この間隙により研磨布2と試料B研磨面とが非接触、又はこれに近い状態における研磨が可能となる。このようにして前述の方法よりもさらに試料B研磨面を均一に研磨することができる。

【0040】また、試料Bがシリコンウエハ基板上に配線及び絶縁膜を形成したウエハである場合に、上述の研磨装置を用いて研磨する方法を以下に説明する。図2は、試料Bの構造を示す模式的断面図である。直径8インチの大口径シリコンウエハ基板31の平坦性は2~3μmであり、この上に配線34、34…が形成され、これを覆って絶縁膜33が堆積されている。絶縁膜33の膜厚分布が10%であり、試料Bの平坦性は3~4μmである。このように試料Bを真空チャック4により試料保持台3上に

固定する。弾性体201にはシリコンゴム（厚み略15mmから20mmまで、 $H_s = 55$ 、引張強さ80kg/cm²）、研磨布2はポリウレタン樹脂と繊維との混合体を使用し、弾性体201が略0.1mm変形する程度の張力に調整し、研磨布2の厚みは0.8mm以下とし、可能であれば0.5mm以下とする。まずSiO₂超微粒子（平均粒径0.1μmから0.2μmまで）を弱アルカリ（pH10から12まで）液に懸濁させた研磨剤8を3リットル/分で研磨面に供給しながら、研磨定盤1を2000rpm、試料Bを載置している試料保持台3を200rpmで回転させる。

【0041】研磨布2は研磨の厚み0.8mm以下にしたものを使用しているため、研磨布2及び弾性体201は試料Bの接触面のマクロ的な凹凸に形状が沿い、かつ、研磨布2は試料Bの接触面のミクロ的な凹凸に形状が沿わないので、試料B全面で効率良くミクロな平坦化が行える。

【0042】なお、研磨布2の厚みは、例えばクロロブレン製のスポンジのような柔らかい材質の場合は、弾性体201の変形量変化が3~4μmに対して、研磨定盤1の圧力変化が20%以下となるように設定することが望ましい。また研磨布2には、上述の実施例で示されたものの以外に、テフロン製のシート、不織布、発泡製ポリウレタン樹脂、又は酸化セリウムのような酸化物粒子若しくはダイヤモンド粒子入りの樹脂等であっても良い。

【0043】図3は本発明の第2実施例を示す部分断面正面図である。研磨定盤1は上面中心が回転スピンドル6の下端部と直結され、水平回転可能となっている。研磨定盤1の下方には、水平回転、水平移動可能なスピンドル55上に載設された試料保持台3が配設されている。スピンドル55は研磨定盤1と同心位置に配置され、スピンドル55の回転中心が研磨布2の中心から周縁方向へ試料の略半径長を水平移動することができる。

【0044】研磨定盤1の下面には同心の円形をしたくぼみが形成されている。このくぼみには、一面が球面状を有する円盤状の弾性体202が嵌着されている。そしてその周縁部はくぼみの深さよりも厚く、弾性体202は研磨定盤1よりも突出した状態をなしている。

【0045】この弾性体202を被って研磨布2が第1実施例と同様に固定されている。このような装置により研磨を行う場合は、まず試料Bを試料保持台3上に載置する。そして試料保持台3を、その中心が研磨定盤1の中心から試料Bの略半径長だけ研磨定盤1周縁方向に水平移動して研磨を行う。このようにして試料B研磨面を均一に研磨することができる。また、研磨定盤1を回転させる回転スピンドル6を鉛直方向に数度傾けた状態で研磨を行うことにより、研磨布2の試料Bへの接触位置の集中を避け、研磨布2の耐磨耗性を向上することができる。

【0046】図4は本発明の第3実施例を示す部分断面正面図である。図中1は円盤状の研磨定盤であり、上面

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中心が回転スピンドル6の下端部によって連結され、水平に回転可能となっている。研磨定盤1の下方には、水平回転及び水平移動可能なスピンドル55上に載設された試料を載置する円板状の試料保持台3が配設されている。スピンドル55は研磨定盤1と同心位置に配置され、スピンドル55の回転中心が研磨布2の中心から周縁方向に少なくとも試料の半径長だけ水平移動することができる。

【0047】研磨定盤1の下面には、同心の円形をしたくぼみが形成されている。研磨定盤1の下側には研磨布2の周縁部が第1実施例と同様に固定リング102,103,103,及びボルト104,104…により固定されている。研磨定盤1及び研磨布2の間に封入袋9が遊挿されている。そして封入袋9に液体203を供給するための供給用ダクト10が回転スピンドル6の中心部を通して封入袋9の上面中央部に装着されている。

【0048】この供給用ダクト10より封入袋9へ液体203が注入され、研磨定盤1及び研磨布2の間に、球面状を有する流体封入部が形成される。そして、研磨布2の中央付近には研磨剤8を噴出する研磨剤供給ノズル7が配置されている。このような装置で研磨する場合は、まず試料Bを試料保持台3上に載置する。そして前記供給用ダクト10から封入袋9に、図示しない定圧ポンプを用いて液体203を注入することにより、封入袋9内の液体203の圧力を調整することができる。このとき、研磨布2は液体封入部の形状によりその下面がほぼ球面となっている。

【0049】次に試料保持台3の回転軸及び研磨定盤1の回転軸が同一鉛直線となる位置に試料保持台3を移動させ、夫々の回転を開始し、研磨を行う。このようにして試料B研磨面の各位置をほぼ一定の圧力で押圧することにより均一に研磨することができる。試料保持台3は、上記のように研磨定盤1と回転軸が同一となる位置に固定して研磨しても良いが、試料の半径方向に移動させながら研磨しても良い。なお、本実施例では封入袋9に液体を封入しているが、液体に代えて気体を封入してもさしつかえない。

【0050】図5は本発明の第4実施例を示す研磨装置の模式的部分断面図であり、前述の第1実施例である、図1に示した研磨装置の研磨布2、環板状の弾性体201及び試料Bを拡大した断面図である。図5(a)に示すように、研磨布2は、例えば軟質ウレタンゴムのような第2の弾性体204の試料Bとの接触側に樹脂ペレット205,205…を埋め込んだ構造のものであり、この研磨布2と研磨定盤1(図1)との間にクロロブレンゴムからなる弾性体201を介在させてある。樹脂ペレット205,205…には、塩化ビニル又はポリエチレンからなる直径0.3mmの球状のものを用いる。試料Bはシリコンウエハ51上に配線54,54…及び絶縁膜53が形成された構造のものであり、前述の第1実施例と同様の研磨を行うことによ

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り、表面の絶縁膜53を研磨する。試料Bの表面は配線54,54…により凹凸状になっており、研磨の際に、研磨布2が有する樹脂ペレット205,205…が絶縁膜53の凸部分を選択的に研磨し、凹部分には接触しない。これにより、ミクロ的にみた試料Bの平坦性が向上される。

【0051】また、図5(b)は、図5(a)の研磨布2、環板状の弾性体201及び試料Bをマクロ的に示した模式的断面図である。なお、樹脂ペレット205,205…及び配線54,54…は省略している。試料B表面を研磨したとき、研磨布2の第2の弾性体204の弾性変形により、マクロ的にみた試料B表面の形状に研磨布2の形状が沿い、試料B表面の研磨の程度が均一となる。

【0052】なお、上述の樹脂ペレットは第2の弾性体よりも固いものが好ましく、塩化ビニル又はポリエチレンからなる直径0.3mmの球状のものを用いているが、これに限るものではなく、粒径1μm以下のAl, O, , CeO₂又はダイヤモンド等の粒子を、塩化ビニル又はポリエチレン等に含有させたものでも良い。

【0053】また、上述の第4実施例では研磨布2の樹脂ペレット205,205…が第2の弾性体204の試料B側面に埋設された状態の場合を説明しているが、例えば第2の弾性体204の試料B側面に設けられた接着面に固定され、着設された状態であっても良い。

【0054】次に、図6は本発明の第5実施例を示す研磨装置の模式的部分断面図であり、前述の第1実施例である、図1に示した研磨装置の研磨布2、環板状の弾性体201及び試料Bを拡大した断面図である。図6に示すように、研磨布2は第2の弾性体205の試料Bとの接触側に凹部206a,206a…を設けた形状のものを用いる。第2の弾性体206は、例えば不織布にウレタンゴムを含有させて硬化化したような厚み1.5mmのパッドであり、これに開口部分が0.1mm×0.1mmで深さが1.4mmの寸法の凹部206a,206a…がピッチ1.5mmで設けられている。試料Bはシリコンウエハ51上に配線54,54…及び絶縁膜53が形成された構造のものであり、SiO₂超微粒子(平均粒径0.05μmから0.2μm程度)を弱アルカリ(pH10から12まで)液に懸濁させた研磨剤8を3リットル/分で研磨面に供給しながら、研磨定盤1を2000rpm、試料Bを載置している試料保持台3を200rpmで回転させる。そして、前述の第1実施例と同様に研磨を行う。このとき、研磨布2の第2の弾性体206は硬質なものであるため、試料Bのミクロな凹凸に追従せず、試料Bのミクロ的な平坦性が向上する。また、研磨布2の第2の弾性体206に凹部206a,206a…が形成されたことにより、試料B表面の形状に沿い、マクロ的に試料B表面の研磨量が均一となる。

【0055】なお、上述の実施例5で用いられた研磨布2の第2の弾性体206に設けられた凹部の開口部分は、0.1mm×0.1mmの寸法であるが、これに限るものではなく、溝状の凹部であっても良い。また、第2の弾性体20

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6の試料B側表面に凸部が設けてあっても良い。

【0056】次に、上述した第4実施例装置を用いてS10。膜を堆積したウエハを研磨し、その平坦性を測定した結果を示す。図7は、図5(a)に一部を示した研磨装置で研磨を行う毎の試料B表面の段差を測定した結果のグラフである。縦軸は表面の段差を示し、横軸は配根パターンの位置(寸法)を示している。グラフから明らかなように、研磨以前の略2 μ mの段差が研磨回数と共に0.5 μ mまで減少し、平坦性が向上していることが判る。

【0057】

【発明の効果】以上のように本発明の研磨装置及びこれを用いた研磨方法においては、研磨定盤及び研磨布の間に、環状若しくは一面が球面状を有する円盤状の弾性体、又は流体を介在させるので、研磨布面と試料研磨面との接触状態が均一になり、試料の平坦度を向上させることができる。また流体の圧力を制御することができるので、研磨布面の試料研磨面への押力を容易にコントロールすることができる。

【0058】さらに、研磨布面と試料研磨面との間に間隙を設けて、この間隙に研磨剤を供給して研磨を行うので、試料に与える負荷が低減され、試料の平滑性を向上し、研磨歪を減少させることができる。

【0059】また、研磨布に第2の弾性体を用い、この弾性体の試料接触面側に樹脂ペレットおよび/または研磨剤粒子が埋設または着設されることにより、試料をマクロ的に均一な厚みに研磨し、試料研磨面のミクロ的な平坦性が向上される。さらに、試料接触面に凸部、凹部又は溝部を設けた第2の弾性体の研磨布を用いることにより、試料をマクロ的に均一な厚みに研磨し、試料研磨面のミクロ的な平坦性が向上される。また、研磨定盤及び研磨布の間に弾性体を介在させ、さらに研磨布に第2の弾性体を用いることにより、試料の平坦性を一層向上させる等、本発明は優れた効果を奏する。

*【図面の簡単な説明】

【図1】本発明の第1実施例の研磨装置を示す部分断面正面図である。

【図2】研磨試料の一部分を示す模式的断面図である。

【図3】本発明の第2実施例の研磨装置を示す部分断面正面図である。

【図4】本発明の第3実施例の研磨装置を示す部分断面正面図である。

【図5】本発明の第4実施例の研磨装置の一部分を示す模式的断面図である。

【図6】本発明の第5実施例の研磨装置の一部分を示す模式的断面図である。

【図7】第4実施例の研磨装置で研磨を行う毎の試料表面の段差を測定したグラフである。

【図8】従来の研磨装置の構造を示す斜視図である。

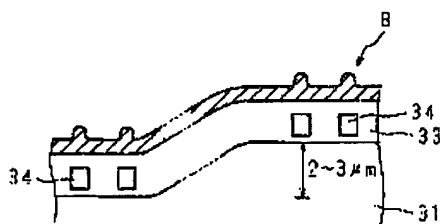
【図9】従来の研磨装置の一部分を示す模式的断面図である。

【図10】従来の研磨装置の一部分を示す模式的断面図である。

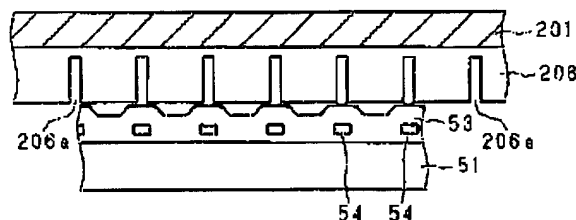
【符号の説明】

- 1 研磨定盤
- 2 研磨布
- 3 試料保持台
- 8 研磨剤
- 9 封入袋
- 10 供給用ダクト
- 201, 202 弾性体
- 203 液体
- 204 第2の弾性体
- 205 樹脂ペレット
- 206 第2の弾性体
- 206a 凹部
- B 試料

【図2】



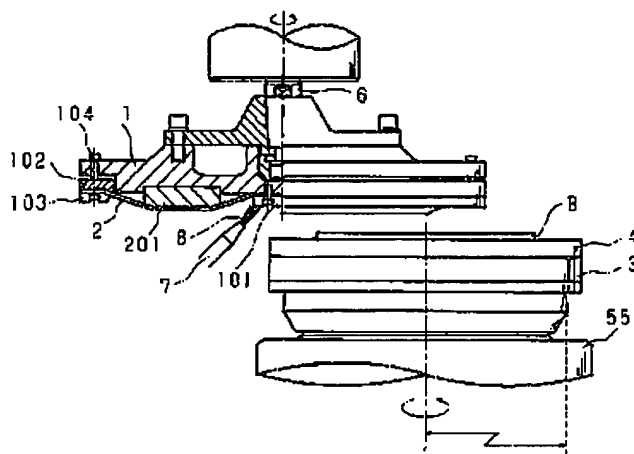
【図6】



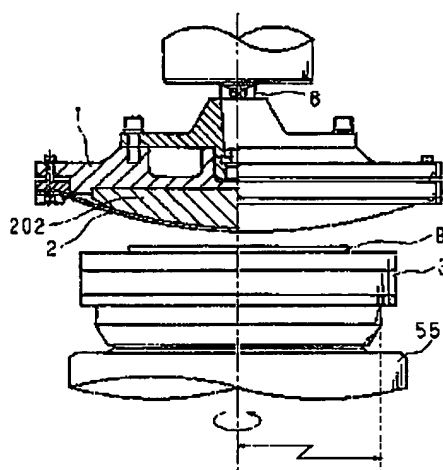
(9)

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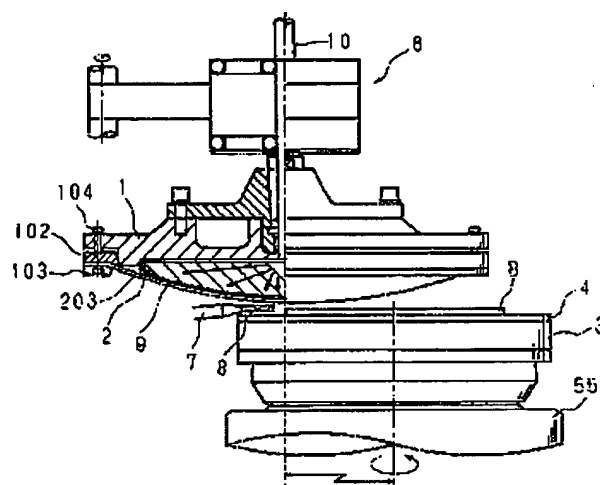
【図1】



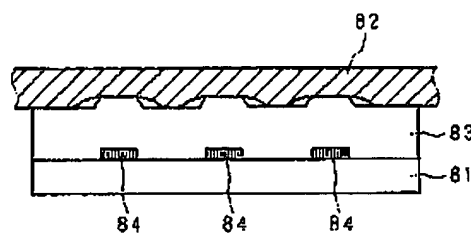
【図3】



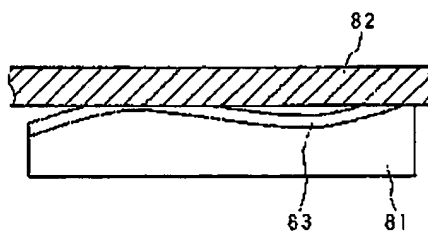
【図4】



【図9】



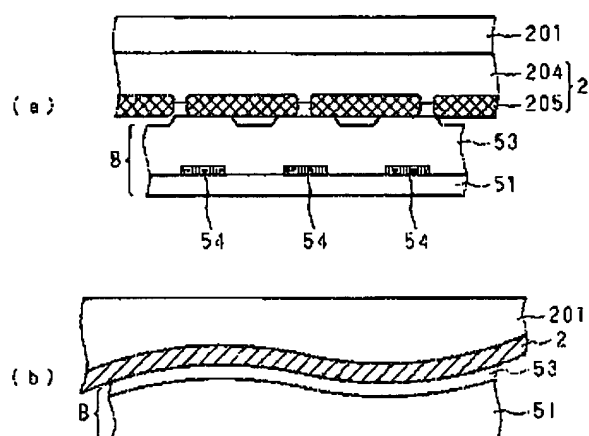
【図10】



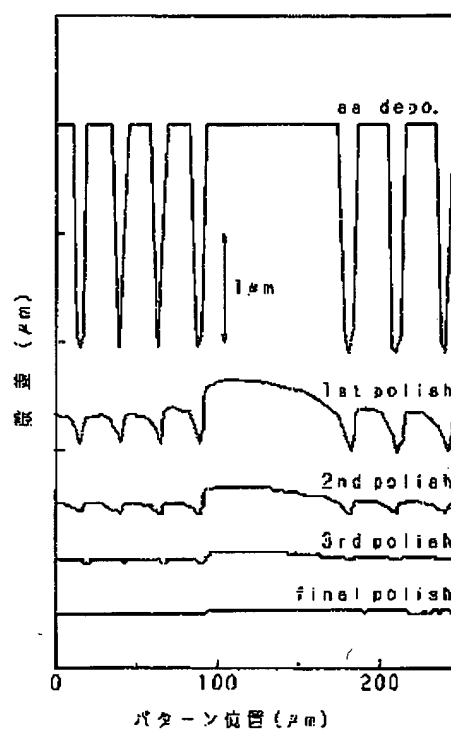
(10)

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【図5】



【図7】



【図8】

